

3.4.1 Caribbean Region

The Caribbean Region workshop in Miami represented the initial application of the workshop process among the eight regions. The participants at this workshop added unique value to the regional workshops in their willingness to provide initial feedback to facilitators and make detailed recommendations for improvements to specific portions of the workshop process.

The participants at this workshop placed considerable emphasis on corals and coral reefs, an emphasis not unexpected given the population of unexplored and infrequently monitored coral reefs in the region. A particular theme was the exploration of deep corals and their relationships to fisheries habitats. Discussion centered on determining the health of reefs, performing assessments, and comparing various areas for genetic connectivity.

The group was stimulated by a discussion surrounding marine caves. The participants showed great interest in the exploration of marine caves since it represented an innovative emphasis area that held the promise of considerable discoveries.

This workshop was attended by a large contingent of participants interested in applicable technologies. This background led to significant discussion on the development of new technologies to satisfy ocean exploration needs. Examples included the development of improved imaging technology, new diagnostic and early warning (at the molecular level) devices, miniaturized probes and sensors for discovering bioproducts, and improved mapping tools for night operations.

The participants brought up an interesting question concerning the geographic application of ocean exploration (coastal versus open ocean). It was concluded by the attendees that near-shore exploration should be considered since its applicability would likely be determined by the nature of the information sought in the coastal zone.

Results from the Caribbean workshop are provided in Table 3.3. Regional exploration targets of interest nominated by participants are illustrated in Figure 3-1.

Table 3-3. Caribbean Region Workshop Results

| Caribbean Workshop: | |
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| Standard Package⁶: Class I/II Vessel with acoustic mapping; Dive capability (ROV/AUV/ Submersible) with imagery/video and sampling equipment; precise positioning system; surface sampling; bench mounted ocean instruments; good pumped water (rapid input); gas detection system; ADCP; bio-acoustic profiling system; multibeam system; sediment and rock sampling equipment | Standard Partners⁶: U.S. Geological Survey (USGS); National Aeronautics and Space Administration (NASA); NOAA; Coast Guard; Navy; National Geographic; National Science Foundation (NSF); Office of Naval Research (ONR); NURP |

| Caribbean Workshop Results: | | | | | | |
|------------------------------------|-----------------|--|---|---|--|---|
| ID | Category | Information Need/Gap | What | Where | Enabling Technologies | Partners |
| 55 | Archeology | Distribution and nature of submerged archeological resources | For shipwrecks; prehistoric sites; and submerged historical sites determine nature of site and date it | Pan-Caribbean; Mona passage; Southern Bahamas; Florida Keys; Reef areas in general since lots of shipwrecks occur there | Standard Package; Standard diving and archeological techniques; Historical records; Develop ability to properly core and chemically characterize site; GIS to make successful and broad range availability | Standard Partners; National Endowment for the Humanities; Non-governmental organizations (NGO's); private and corporate partners; affinity groups; Discovery Channel; Florida State University; Massachusetts Institute of Technology (MIT); Texas A&M (TAMU); William and Mary; University of Bahamas; Smithsonian |
| 80 | Archeology | Exploration in Time | Review historical records; Examine trading patterns; Utilize Genetic Resources; How were the islands colonized?; How people have used (socio economic; cultural) the oceans in past and how has it affected present condition?; Where are we heading? | Pan-Caribbean | Standard archeological techniques; ethnographic data; Zoological techniques | Standard Partners |
| 69 | Archeology | Nautical charts from 15th century on - digitize and look at technology and scale to provide historical record; look at evolution of technology | Database - compile current info and map uncharted areas to add to knowledge | US coastal-wide; make this proposal driven to determine 'where'? | Mapping tools and technologies | Standard Partners |

| Caribbean Workshop Results: | | | | | | |
|------------------------------------|-------------------------------|--|---|---|---|--|
| ID | Category | Information Need/Gap | What | Where | Enabling Technologies | Partners |
| 78 | Boundary Fluxes - Air/Sea | Air/Sea Interactions on the small scale | Document the biological; chemical; and physical processes of the air/sea interface in high resolution over a small area | Caribbean - hurricane source; pan-Caribbean in highly dynamic regions | Develop new sensors to document air/sea interactions on a small scale | Standard Partners |
| 101 | Boundary Fluxes - Basins | Impact of fresh water runoff & suspended/dissolved "stuff" | Identify and quantify impact of fresh water runoff & suspended/dissolved matter | All Coastal Regions | | Standard Partners |
| 94 | Boundary Fluxes - Water Mass | Dynamics of interaction between water masses | | Florida Straits; Virgin Islands (VI) - Anegada Passage; loop current production to Florida Straits | Standard Package | Standard Partners |
| 52 | Corals - Deep Water | Distribution and status of deep water coral reefs and fish stocks | Collection information on the distribution; taxonomy; abundance; condition; diversity; and size of deep corals and fish stocks; | PR; dry Tortugas; VI; Lang Bank; Shelf bank and wall at VI and PR; Nevassa Island; Columbian Banks; Florida Straits; South end of Cuba; Marquesas; Lots of Places - beyond >20m | Standard Package; remote sensing; technical diving; optics; radio tagging; GIS | Standard Partners; Equipment manufacturers; other commercial operators such as major oil companies; Minerals Management Service (MMS) |
| 53 | Corals - Shallow Water | Health and assessment of shallow water coral reefs | "Norms" (coral; fish; biomass) of condition for comparison; One time assessment | Pan-Caribbean shallow water; Marquesas; Tortugas Bank; Islamorada Humps; Riley's Hump | Visual technologies such as SCUBA; hypospectral techniques; aerial photography; develop new diagnostic or early warning technologies - molecular level technologies; remote sensing | Standard Partners; tourism agencies; hotels; hospitality agencies; private foundations |
| 84 | Ecosystem - Abrupt Topography | Impacts of underwater topography (Sea mounts, pinnacles, reef edges) | | Warm water environments; banks; shelf edge | Standard Package | Standard Partners |
| 86 | Ecosystem - Abrupt Topography | Understanding the ecology and oceanography of Florida Straits | Examine source water currents; pollutants; nutrients; and plankton | Florida Straits; VI; Puerto Rico | Standard Package; airborne LIDAR; hyper-/multi-spectral optics (species ID); tracking of tagged fish; human diving technologies; wide bandwidth communications (via LEO SAT); drifters; probes; instrument arrays; fixed ADCP | Standard Partners; state & local agencies; South Florida Ocean Measurement Center (SFOMC); RSMAS; local labs; Immigration and Naturalization Service (INS); Central Intelligence Agency (CIA) Environmental and Societal Issues Center (DESC); U.S. Customs; National Ocean Partnership Program (NOPP); OCEAN.US |

| Caribbean Workshop Results: | | | | | | |
|------------------------------------|--|---|--|---|--|--|
| ID | Category | Information Need/Gap | What | Where | Enabling Technologies | Partners |
| 92 | Ecosystem - Abrupt Topography | Trenches | Exploration in trench region to understand the interactions between abyssal depths and shelf waters (including abiotic/biotic constituents) | Puerto Rico Trench and surrounding area | Standard Package; deep submersible; deep ROV/AUV (multipurpose); surface deployed sampling/analysis devices (cost saving versus deep dive); low light optics; communications | Standard Partners |
| 59 | Ecosystem - Banks & Basins | Deep basins | Document biogeography and taxonomy; document physical; chemical; geological; and sediment characteristics | Caribbean basins (4); PR trench | Standard Package; dredging; visual; trawling; trapping; coring. | Standard Partners |
| 57 | Ecosystem - Caves | Biodiversity and ecology of marine caves | Characterize and Identify biota using molecular genetics; map; determine chemical; geological; biochemical; and physical characterization; geology; examine for archeological significance | Bermuda; Bahamas; Yucatan; Greater Caribbean | Standard Package; traditional sensors; satellite photos; technical diving; GIS mapping; cave cam; drilling; data processing and visualization tools; remote samplers; coring; smaller tools (bore hole size) | Standard Partners; pharmaceutical industry; biotech; medical manufacturers; equipment manufacturers; U.S. Department of Agriculture (USDA); cosmetic companies; National Institutes of Health (NIH); Sea Grant; National Center for Natural Products Research (NCNPR); Scripps Institution of Oceanography (SIO); Smithsonian; commercial operators such as charter boats; cave divers; fishermen; hunters; taxonomist |
| 58 | Ecosystem - Extreme Environment - Vents, Seeps | Find new vents and seeps (includes fresh water seeps) | Document biogeography and taxonomy; Document physical; chemical; geological; and sediment characteristics | Fresh water communities as well as marine; brine pools; Cayman trench; PR trench; any seismically active area | Standard Package; deployment of platforms that stay in place for long term monitoring; thermal mapping; salinity measurements; technical diving in some of the shallower vents | Standard Partners; pharmaceutical industry; biotech; medical manufacturers; equipment manufacturers; USDA; cosmetic companies; NIH; Sea Grant; NCNPR; SIO; Smithsonian; commercial operators such as charter boats, fishermen, hunters; taxonomists |
| 340 | Ecosystem - Extreme Environments - Vents, Seeps, & Volcanoes | Kick'em Jenny Volcano | Fully document this active volcano, which is likely to be the next Caribbean island | Kick'em Jenny Volcano (Approximately 4 miles north of Grenada) | Standard Package | Standard Partners |

| Caribbean Workshop Results: | | | | | | |
|------------------------------------|----------------------------------|--|---|---|---|---|
| ID | Category | Information Need/Gap | What | Where | Enabling Technologies | Partners |
| 63 | Ecosystem - Shorelines to Ledges | Status of fish stocks and habitat on the Islamorada Hump | Collect information on distribution; taxonomy; abundance; condition; and diversity | Islamorada Hump; Florida Keys | Standard Package; advanced diving; passive acoustics | Standard Partners |
| 85 | Ecosystem - Shorelines to Ledges | Knowledge of fisheries habitats | Scope and variability of tropic productivity in reef systems | 20-200m | Standard Package; develop acoustic techniques for classification (benthic; reef; and water column organisms); airborne LIDAR; hyper-/multi-spectral optics (species ID); tracking of tagged fish; human diving technologies | Standard Partners; congressional mandate; state & regional; territorial agencies & councils; sport fishing; commercial fisheries; private industry (Ocean Fishing Forecasting Industry); Florida Marine Labs (Harbor Branch Oceanographic Institute, Mote Marine Laboratory); RSMAS |
| 66 | Geology & Geomorphology | Sea floor sediments Holocene (last 10,000 yrs) | What are they? How thick are they and what events do they record? | Florida deep water below 30 meters; VI; PR | Standard Package; Standard geological sampling; acoustics; develop new technologies - lasers; etc | Standard Partners |
| 95 | Human Impacts | Impacts of pollution | Anthropogenic impacts on marine mammals and their habitats from ships; blast fishing; military operations; energy refineries and energy conversion activities | Puerto Rico (super-port); Bahamas; St. Croix; Florida current; deep trenches | Sound Surveillance System (SOSUS); deployed arrays; ship surveys; systematic observations | Standard Partners |
| 70 | Marine Microorganisms | Microorganisms | Knowledge of the diversity; abundance; function; behavior; and identity of marine microorganisms; impact on ecosystems and human & habitat health | Water; sediments; organisms; wide range of depths and areas; reefs | Genomics; micro-arrays; conversion of molecular data to signals; real-time remote analysis genomics; new culture techniques | Standard Partners; NIH; Public Health Service; Pharmaceutical Industries; global climate community; reinsurance & insurance industry; Japan; Russia; France; Wood Hole Oceanographic Institution (WHOI) and ALVIN submersible; energy industries |
| 56 | Marine Organisms | All taxa biodiversity inventory | Species inventory; Identify chemical characteristics; discover and inventory new living resources (non-fishery) with commercial potential | Florida Straits; deep water habitats in Caribbean; location where there is already a lot of information such as Florida Keys or Salt River Canyon in St. Croix (long-term hydrolab mission) | Standard Package; tech diving; develop new sampling tools (new probes; sensors; samplers (miniaturized)) and new tools to keep samples alive (high pressure; low temp containers); taxonomic expertise | Standard Partners; pharmaceutical industry; biotech; medical manufacturers; equipment manufacturers; USDA; cosmetic companies; NIH; Sea Grant; NCNPR; SIO; Smithsonian; commercial operators such as charter boats, fishermen, hunters; taxonomists; many universities |

| Caribbean Workshop Results: | | | | | | |
|------------------------------------|----------------------------------|--|--|---|--|-------------------|
| ID | Category | Information Need/Gap | What | Where | Enabling Technologies | Partners |
| 60 | Marine Organisms | Learn status and habitats of spawning aggregations of fish | Document distribution; taxonomy; abundance; condition; and life history; mechanisms underlying fish aggregations including pelagic and benthic areas | VI; Nevassa Islands; Columbian Banks (joint treaty); VI; Puerto Rico; Bahamas; Florida Straits; Mexico; Belize; closed areas and Marine Protected Areas | Standard Package; optical technologies; visual observations; technologies that work at night; rebreathers/mixed gas; radio tagging | Standard Partners |
| 77 | Marine Organisms | Distribution of marine geographic endemics | Document taxonomy; distribution; and life history | Start at geographically distinct areas such as Florida Keys and compare to US VI | Sampling techniques; molecular genetic techniques | Standard Partners |
| 79 | Marine Organisms | Deep diving and long range marine mammals | Observe visual behavior; environment; and habitat through use of all senses | Wherever they go!; Several Caribbean wintering ground basins; nursery areas; feeding grounds | Design new technologies - non-invasive and otherwise that follow these mammals | Standard Partners |
| 98 | Marine Organisms | Connection of separated populations (esp. fish) | How Habitats impact each other | Throughout Caribbean | | Standard Partners |
| 102 | Marine Organisms | Linkage between marine mammals & food source/distribution (includes vertical migrates) | | | Migrating instruments | Standard Partners |
| 88 | Ocean Resources - Bioprospecting | Application of new micro/macro organisms on drug discoveries & other industrial products | Biotechnology | Deep reefs; vent; seeps | Standard Package | Standard Partners |

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Caribbean Region Exploration Targets of Interest

1. Anegada Passage
2. Bahamas
3. Barbados
4. Belize
5. Cayman Trench
6. Cayman Trough
7. Columbian Banks (not on chart)
8. Dry Tortugas & Tortugas Bank
9. Exumas Island Chain
10. Florida Straits
11. Islamorada Hump
12. Lang Bank
13. Mona Passage
14. Montserrat
15. Navassa Island
16. Puerto Rico – shelf bank
17. Puerto Rico Trench
18. Riley's Hump
19. Salt River Canyon
20. St. Croix
21. Tongue of the Ocean - locally known as TOTO
22. Trinidad
23. US Virgin Islands – shelf bank
24. Windward Island
25. Yucatan

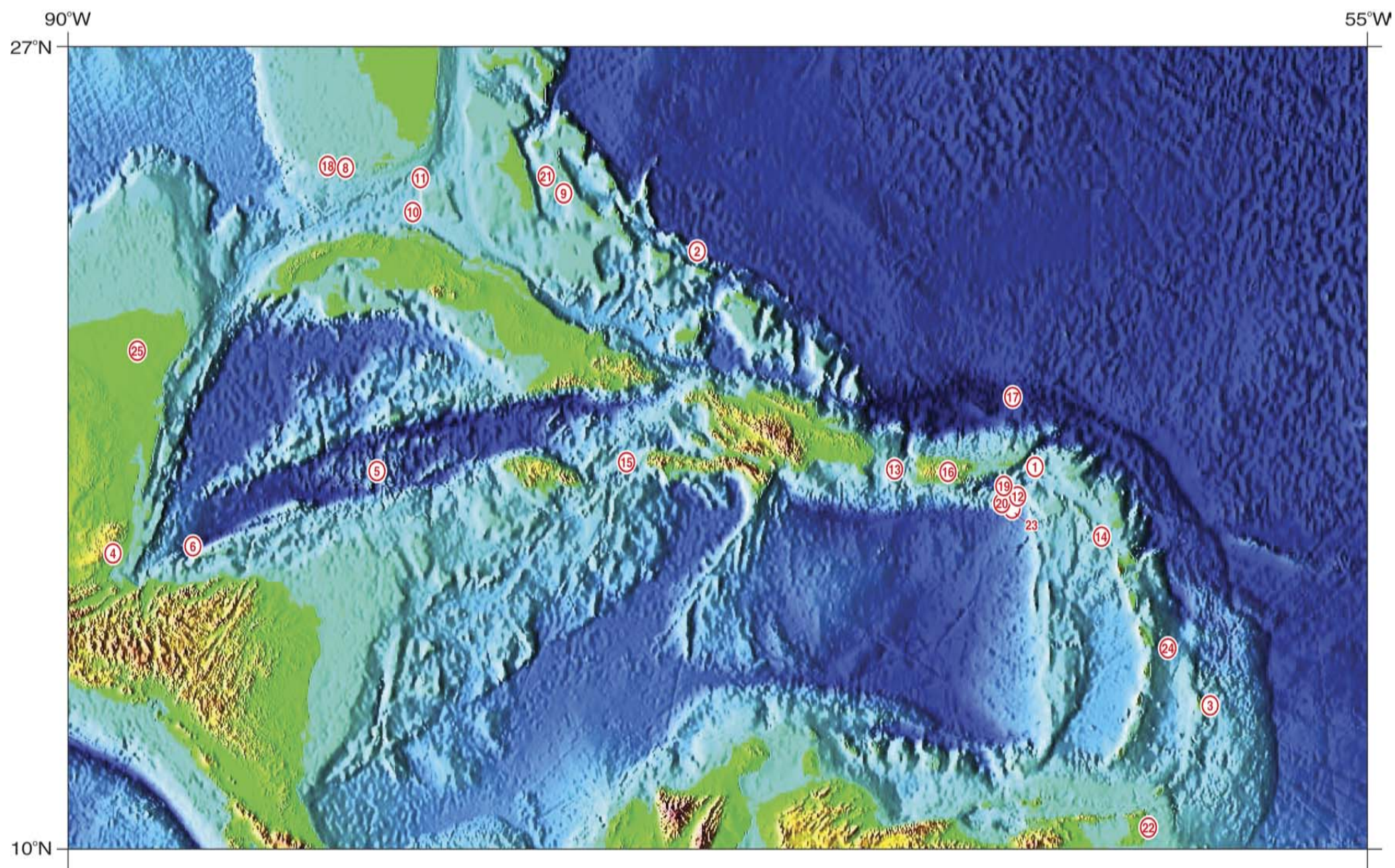


Figure 3-1. Caribbean Region Exploration Targets of Interest